CLAIMS

1. A method for surface processing by plasma polymerization of a surface of a metal by using a DC discharge plasma, comprising the steps of:

(a) positioning an anode electrode which is substantially of metal to be surface-processed and a cathode electrode in a chamber;

(b) maintaining a pressure in the chamber at a predetermined vacuum level;

(c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and

(d) applying a voltage to the electrodes in order to obtain a DC discharge, whereby to obtain a plasma consisting of positive and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer gas or the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophilicity or hydrophobicity on the surface of the anode electrode by plasma deposition.

2. A method for surface processing by plasma polymerization of a surface of an insulating material such as polymer or ceramic material by using a DC discharge plasma, comprising:

(a) positioning a metallic anode electrode and a cathode electrode in a chamber, wherein the insulating material to be surface-processed is positioned closely proximate to a surface of the metallic anode electrode;

(b) maintaining a pressure in the chamber at a predetermined vacuum level;

(c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and

(d) applying a voltage to the electrodes in order to obtain a DC discharge, whereby to obtain a plasma consisting of positive and negative ions and radicals generated from the unsaturated aliphatic hydrocarbon monomer gas or the fluorine containing monomer gas and the non-polymerizable gas, and

then forming a polymer with hydrophilicity or hydrophobicity on the surface of the insulating material proximate the anode electrode by plasma deposition.

3. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein the DC discharge is performed periodically in the form of on/off pulsing during a total processing time in order to improve the hydrophilicity of the polymer.

4. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein the polymer obtained in the step (d) is surface-processed by a plasma of at least one non-polymerizable gas selected from a group consisting of O_2, N_2, CO_2, CO, H_2O and NH_3 gas in order to improve the hydrophlicity of the polymer.

5. The method for surface processing by plasma polymerization according to claim 4, wherein the nonpolymerizable gas is used with an inert gas.

6. The method for surface processing by plasma polymerization according to claim 4, wherein in the additional plasma processing, the electrode or insulating material on which the polymer is deposited in the step (d) is used as a cathode.

7. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein in the step (d), the polymerization process by the plasma is performed for 1sec- 2min.

8. The method for surface processing by plasma polymerization according to claim 7, wherein in the step (d), the polymerization process by the plasma is performed for 5sec- 60sec.

9. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein the ratio of the unsaturated aliphatic

hydrocarbon monomer gas and the non-polymerizable gas is varied whereby to vary the properties of the polymer.

10. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein the ratio of the fluorine-containing monomer gas and the non-polymerizable gas is varied whereby to vary the properties of the polymer.

11. The method for surface processing by plasma polymerization according to claim 10, wherein the fluorine-containing monomer gas comprises a monomer gas consisting of C, H and F such as $C_2H_2F_2$, C_2HF_3 and containing at least one carbon double bond.

12. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein the non-polymerizable gas is 0-90% of the whole gas mixture.

13. The method for surface processing by plasma polymerization according to claim ~~1 or~~ 2, wherein the polymer is annealed at a temperature of 100 - 400°C in the ambient atmosphere for 1 - 60min.

14. A method for surface processing by plasma polymerization of a surface of a materials including a metal, a ceramic or a polymer by using an RF discharge plasma, comprising the steps of:

(a) positioning a passive electrode which is of the material to be surface-processed and an active electrode which is substantially of metal in a chamber;

(b) maintaining a pressure in the chamber at a predetermined vacuum level;

(c) blowing an unsaturated aliphatic hydrocarbon monomer gas or a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and

(d) applying a voltage to the electrodes in order to obtain an RF discharge, whereby to obtain a plasma consisting of positive and negative ions

and radicals generated from the unsaturated aliphatic hydrocarbon monomer gas or the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophilicity or hydrophobicity on the surface of the passive electrode by plasma deposition.

15. The method for surface processing by plasma polymerization according to claim 14, wherein properties of the polymer are determined by the ratio of the unsaturated aliphatic hydrocarbon monomer gas and the non-polymerizable gas.

16. The method for surface processing by plasma polymerization according to claim 14, wherein properties of the polymer are determined by the ratio of the fluorine-containing monomer gas and the non-polymerizable gas.

17. The method for surface processing by plasma polymerization according to claim 16, wherein the fluorine-containing monomer gas comprises a monomer gas consisting of C, H and F such as $C_2H_2F_2$, C_2HF_3 and containing at least one double bonding of carbon.

18. The method for surface processing by plasma polymerization according to claim 14, wherein the polymer is annealed at a temperature of 100 - 400°C in the ambient atmosphere for 1 - 60 min.

19. A method for surface processing by plasma polymerization of a surface of materials including a metal, a ceramic or a polymer by using an RF discharge plasma, comprising the steps of:

(a) positioning an active electrode which is of the materials to be surface-processed and a passive electrode which is substantially of metal in a chamber;

(b) maintaining a pressure in the chamber at a predetermined vacuum level;

(c) blowing a fluorine-containing monomer gas at a predetermined pressure and a non-polymerizable gas at a predetermined pressure into the chamber; and

(d) applying a voltage to the electrodes in order to obtain an RF discharge, whereby to obtain a plasma consisting of positive and negative ions and radicals generated from the the fluorine containing monomer gas and the non-polymerizable gas, and then forming a polymer with hydrophobicity on the surface of the active electrode by plasma deposition.

20. A material having a polymer with excellent hydrophilicity or hydrophobicity is fabricated by the method of ~~any one of the preceding claims.~~

21. The material according to claim 20, wherein the material surface has a polymer which exhibits an excellent affinity for paint.

22. The material according to claim 14, wherein the material surface has a polymer which exhibits excellent corrosion-resistance.